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THE
COW-PEA IN THE NORTH.

BY

ALVA AGEE,
Wooster, Ohio.

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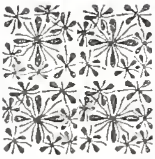

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PREFACE.

Harrisburg, Pa., August 11, 1904.

Until recent years little was known of the cow-pea in Pennsylvania or any other of the Northern States. In the South, where, in some sections, it is known as the "black pea," it has, for some years, been extensively grown, both as a forage and green-manure crop. The writer never had any experience with this plant until last year, when several acres were sown on the farm where the Pennsylvania State Live Stock Sanitary Board is conducting its experiments to determine the possibility of immunizing cattle from tuberculosis. The result of the experiment with the cow-peas was so satisfactory that it was thought that in some sections of the State, at least, the crop might prove a valuable addition to the forage and green-manuring crops grown by our farmers. Arrangements were, therefore, made with Mr. Alva Agee, who is well known to many Pennsylvania farmers, and who has had extensive experience with the cow-pea to prepare this bulletin.

The writer feels assured, not only that the bulletin will be read with interest by many of our people who know the genial author, but that the earnest inquirer will find in it much information that may be turned to good account.

N. B. CRITCHFIELD,
Secretary of Agriculture.

LETTER OF TRANSMITTAL.

Hon. N. B. Critchfield, Secretary of Agriculture, Harrisburg, Pa.:

Dear Sir: I have the honor of submitting to you the manuscript of a bulletin on "The Cow-Pea in the North." In the light of experiment station work, of many years' personal experience with this legume and of somewhat wide observation, the effort has been to point out, as accurately as possible, the ways in which many northern farmers may use the cow-pea with profit.

Respectfully yours,
ALVA AGEE.

Wooster, Ohio, August 1, 1904.

THE COW-PEA IN THE NORTH.

PURPOSE OF THIS BULLETIN.

Where the clovers grow luxuriantly we can have rich soils and rich feed for live stock. If all northern soils were friendly to the clovers, there would be little need of other fertilizing plants; but the trouble is that the land that needs clover most, often fails to grow it. For this reason there is constant search for other legumes that can furnish rich organic matter to the soil and rich feed for animals.

In our Southern states the cow-pea has been used for a century, but its introduction into the clover states has been comparatively recent. Many of the failures that have resulted from trials of this legume have been due to us, and largely because we did not know the nature of the plant and the right way to get the best results from it. I am thoroughly convinced that the cow-pea has a rightful place, and an extensive place, in our northern agriculture, not as a competitor of our clovers, but as a supplement to them. Fifteen years' practical experience with this southern plant in a Northern state, and wide observation throughout many of our states, assure me that this is a fact, and it is the purpose of this bulletin to point out the ways in which the cow-pea may be made to serve a large number of farmers in Pennsylvania.

NATURE OF THE COW-PEA.

The plant that we know as the cow-pea, or Southern pea, is called *vigna sinensis* by the botanists, and is not a pea at all. A knowledge of this fact is important because we associate hardiness in respect to cold with the word "pea," while this plant is tropical in its character and will not thrive in a cold temperature. The name, moreover, has led many northern farmers to confuse it with the Canada pea, which is a true pea and very hardy. The cow-pea resembles the bean very much in its nature and habit of growth. It belongs to the family of plants, called leguminosae, that enrich soils by storing in themselves the nitrogen of the air. The clovers are chief in this family of plants, and to it belong many well-known fertilizing and forage plants. In our Southern states the cow-pea occupies the leading place in this group, being known as the "clover of the South." Its roots add fertility to the soil, and its vines and seed furnish a rich feed for live stock.

ITS PLACE IN THE NORTH.

Being a tropical plant, a native of India, according to the best authorities, its usefulness in American agriculture was supposed for many years to be limited to our Southern states, but this was found to be a mistake. There has been development of hardy varieties, and a better knowledge has been gained of the right use of the plant. No one may say definitely just how far north, or at what elevations, the use of this southern plant may be found profitable, but it is grown to a limited extent in Minnesota and other states on our northern border. The varieties that have been adapted to such latitudes are small in their habit of growth, and do not give the returns for time and labor expended that are secured from larger varieties in warmer regions. The northern boundary of cow-pea production can only be fixed by continued experiment, and it will be a most irregular line, being determined largely by the peculiar soil and cropping conditions of the individual farmer.

Excepting localities needing a summer cover crop or a catch crop, I very much doubt whether there will ever be any large acreage of cow-peas in a latitude north of Pennsylvania and Ohio, except where the heat lines of our country swing northward, carrying the temperature of these states into more northern territory, as is the case in portions of the New England states. Moreover, in the portions of Pennsylvania that have a high elevation, we may not expect decidedly satisfactory results from this tropical crop. However, it is not for me to try to fix its limitations, but rather to say that large districts of Pennsylvania can secure much value from it if they will employ it to the best advantage. This is now being done by isolated farmers throughout New Jersey, Pennsylvania, Ohio, Indiana and Illinois, and the number of such farmers will increase many fold when full knowledge of the Southern pea has been acquired. In this connection, I quote from Bulletin No. 69, of the Illinois Experiment Station, as follows:

"The value of the cow-pea and soy bean crops to the Illinois farmer is established. To the grain farmer these crops enter into a rational rotation of crops to maintain fertility, and to the feeder may furnish a valuable supplementary feed to balance his corn ration, so, all things considered, the cow-pea and soy bean crops are certainly entitled to a place in the agriculture of Illinois.

"Cow-pea and soy beans are leguminous plants and compare favorably with clover as soil improvers, and for some purposes possess an advantage over clover, in their quick maturity. Both are annual plants, and they can be used to good advantage as catch crops with corn, or after other crops, when clover would be less practicable.

"Cow-pea and soy beans produce large yields of both hay and grain, the former being equal in feeding value to clover hay and the latter practically equivalent to linseed meal and other concentrated feeds.

"Experiments show that cow-peas and soy beans need plenty of room for their development; frequently they are planted too close for maximum yields of feeds. A seeding of about one-third bushel per acre, drilled in rows of about thirty-two inches apart, seems best for the production of feed.

"Failure to mature seed is commonly due to too close planting or to the use of too late varieties.

"There are varieties of both cow-peas and soy beans which are well adapted to Illinois, and their success as a crop for this State is established."

ITS USES.

In American agriculture two great needs constantly present themselves; one is that of more soil fertility, and the other is that of more muscle-making material in our feeding stuffs. The family of plants, of which clover is chief, in our Northern states has an inestimable value because it supplies our soils with nitrogen and our live stock rations with protein. The cow-pea comes to us as an aid in soil-building and in the work of rational feeding of animals. Our success with it is measured by our ability to fit the crop into our scheme of farming so that the best may be gotten from it. It will be largely a supplementary crop, or a special one that will do a special work for our land or animals. Its chief office in the North, probably, is that of helping to build up the soil.

SOIL-BUILDING.

The ability to make land produce, measures our degree of success, and it is sick fields and sick farms that keep us from getting the share of this world's good things that we want.

When we understand the soil thoroughly, I am sure that we shall find that the Creator provided most land with all that is essential to productiveness when man does his share, and the trouble with most land to-day is that we, as farmers, have not yet learned to do our part right. When we believe this thoroughly, the way is at least half open to success. It does not do to sit down and to imagine that our land lacks ability to do a fair share of the work of feeding the world, and that our own ignorance is not the chief difficulty in the way. Of course, we are not lying awake at night troubling about the world getting fed, but we would like to get some of the money that is being paid for food. That is what interests us. If our land is able to do its part when we do ours right, then we want to know what we are not doing right or what we are leaving undone. This it is that keeps all of us studying year after year, and the man who comes nearest finding out for his own farm is the one who gets the most satisfactory results on his investment.

There are some fundamental truths that we need, and they help us when we try to find the right way of making a field more productive. One of these facts is that most arable land has a big store of all the mineral materials that plants need for their growth, although the supply stored by nature may not be in an available form for use by plants. In case of all lands that have been cropped successfully, this is so universally true that we are justified in assuming that it is true of the land we wish to improve, and in working upon that supposition until we learn that our land is an exception to the rule. I know that we have much land that seems to have become exhausted by hard cropping, but the unproductive condition does not result from any exhaustion of nature's supplies. This is a truth people are slow to accept, but it is a fundamental one.

This so-called exhaustion is a serious matter, but it is only an exhaustion of the relatively small part that is available, or, more likely yet, it is chiefly an impaired physical condition resulting from a loss of humus, so that moisture is not held in right amount, or it is a sick condition due to the presence of acids or something else that prevents helpful bacteria from working. In the case of relatively thin lands that never have been very productive, it is also reasonable to assume that there is an immense amount of tough, locked-up plant food in them, and that unproductiveness is due to one of the causes named, and quite probably to all of them.

I emphasize this truth because it is important, and because it is hard to accept. Not only did the scientists discover it, but thousands of farmers on almost every kind of soil have learned the fact. Nearly all farming land has great natural strength, no matter whether it is in a productive state or not. When we realize that, we have the way open for rational planning. If there were some way of making this material available rapidly as needed by our crops, and if the moisture were under reasonable control, yields would be big from our exhausted and thin lands in most instances. In view of this fact, when we are trying to improve a field, a leading thought should be the unlocking of available plant food.

HUMUS.

Humus is the chief need of most soil. When the soil is filled with decaying organic matter, the inert mineral plant food is being slowly rendered available, and the supply of soil moisture is being conserved. The difficulty is to secure the organic material. For many years I have used cow-peas as a direct means of filling the soil with humus. They were grown in rotation with good cash crops, like potatoes, and the decaying vines and roots furnished fertility for big yields. The vines were plowed down because they paid me as a manure. But in the work of soil-building the peas may do their greatest service to the North by paving the way for sods, and thus adding humus indirectly as well as directly. There is a vast area of land that is bare, or nearly so. At the best, it produces thin grass for a year or two, and then lies almost worthless because it lacks fertility for a cultivated crop, or is so hilly that frequent plowing is ruinous to it. Such land I have first in mind in the presentation of the helpfulness of cow-peas when wisely used.

SODS.

Good sods lie at the foundation of successful farming. One of the best uses of the cow-pea in our Northern states is to pave the way for sod. In the case of thin land, a breaking-plow thoroughly unfits a soil temporarily for making a catch of grass or clover. To secure a sod on thin land the ground should be compact, so that moisture may not be lacking, and especially should the surface soil be able to furnish fertility. Tough, inert soil that has lain for a considerable length of time six or seven inches from the sun, the air and frost, and that has even less than its share of the humus in the land, is wholly unfit to make a new sod, and yet that is the soil we have at the surface when the breaking-plow is used in preparing for seed. This is true even when the breaking has been done for fall grain, when clover is seeded the next spring. The soil at the surface, in the case of thin land, is not in fit condition to make a catch of clover and grass. The soil is not right-side-up.

With fertile land it is very different. Any part of such soil is rich in humus, and the plow brings up soil as fit for feeding tiny plants as the surface soil we turned under.

The thin land must have some available fertility at its surface if we would start clover and grass plants successfully. It is as a crop to precede the seeding to grass that cow-peas come as a boon to the owner of thin soil. I wish that it were possible to bring conviction on this point to the minds of the owners of thin land.

There is an impression that when a thin field fails to make a catch of grass, or when a sod on such land is poor and unprofitable, the ground should be broken and the land reseeded. The soil is not fertile, usually for the reason that the material in it is unavailable for the use of plants. There may be harmful acids in it, due to inability of air and light to penetrate it. The soil nearest the surface is best because it has had exposure to the sun and has had some tillage, and chiefly because it has a little store of vegetable matter in it—some turf or weeds. The breaking-plow buries the little good material that is in the soil—the part that is most available for use as a feeding ground for tiny grass and clover plants—and it brings to the surface the cold, inert material from below. Such soil, when brought to the surface, cannot feed a new lot of grass plants well, it cannot hold moisture, and it lets a crust form that is death to the new catch of grass and clover. Such attempts to get a sod on the thin land we are considering are irrational and doomed to failure, except when a favoring season and some fertilizer nurse the plants through the critical stage.

But the land must be broken to give it an airing, to destroy weeds and to give a fresh seed-bed. That is certainly true, and right here comes one use of cow-peas that could be made the means of redeeming hundreds of thousands of acres of thin land from an unprofitable condition, and of insuring to this land a profitable sod. The land must be broken, but the work should be done many months before the seeding to grass and clover, and in the meantime the new surface soil should be given tillage, exposure to the air, and, best of all, a good supply of humus-making material. This surface soil should have rich organic matter incorporated with it. We know the value of manure as a top-dressing for such land when a seeding is wanted. Our aim is to grow the top-dressing for the land that cannot have manure, and this we can do by use of cow-peas.

The fertilizing crop is not grown to be turned under, thus causing more dead soil to be brought to the surface where the grass seed will be sown, but it is grown to be used as a top-dressing, and it is left on and in the surface soil that needs it for the starting of the sod. The objection may be made that a season's crop is thus lost, so far as immediate cash returns is concerned. But this scheme is for land that would not bring returns that year anyway, on account of soil poverty and a worthless sod. There was no net income in sight—or very little. By means of the peas the land is put into productive condition. It is just as rational to spend some time growing rich organic matter for a top-dressing as to spend time drawing manure, and the plan is for land that cannot have the manure.

A CLEANSING CROP.

In preparing land for reseeding, cleansing from weed seed is most important. It is not feasible to destroy all the seed in the ground, but there should be a thorough cleansing of the surface soil, and this is gotten only by shallow tillage and by use of a smother crop.

When the breaking-plow is used shortly before a seeding for grass, there is brought to the surface a new lot of weed seed that lies ready to germinate when there is the right degree of heat and moisture the next season. The surface soil should be made clean of weed seed during the summer preceding the seeding to grass, and then that clean soil should be left on the surface. The cow-pea is the choice cleansing crop for preparing land for meadow. While it is furnishing the rich humus-making material that will serve as a coat of manure, mulching the surface, enriching it and putting it into prime physical condition, it is the means of providing a seed-bed that is free from most weed seed near the surface. A shallow tillage of the peas and the smothering due to the heavy vine growth secure this result.

PLOWING PEAS DOWN.

In soil-building, emphasis has been placed upon the value of the cow-pea as a preparatory one for seeding to grass and clover. When so used, the vines on thin land are chopped or disked into the surface soil, and on better soil the vines are made into hay, and the stubble is harrowed lightly and seeded to grass. Description of the best methods of growing and handling the crop for this purpose will be given later in this bulletin.

There is, however, a more common use of the crop in soil-building, the aim being merely to add fertility to the soil for a future crop by means of the roots, stubble, and often the vines. Then the crop is treated just as we treat clover, being plowed down, or having the vines made into hay and the stubble plowed down. The practice is entirely good where humus is wanted throughout the soil, and where there is lack of nitrogen in the land, while no need exists of putting the surface of a thin soil into prime condition for starting a sod.

FERTILIZING VALUE.

Red clover is the usual standard of comparison in a farmer's mind when wanting to learn the fertilizing value of any new crop. But the value of clover is most variable, depending upon the rankness of its growth. Some southern authorities state that a cow-pea crop excels a clover crop in value, and this is true under their observation because the peas thrive greatly while the clover is not so well adapted to southern crop conditions. In the North a good clover crop is to be preferred to a crop of peas for soil improvement. The former has no rivals. But clover requires more time for full development than do peas, and it often fails to make a catch or a satisfactory growth, and as a supplementary legume the peas find a big place to be filled in our northern agriculture.

We do want, however, a fair conception of the fertilizing value of this crop, and our experiment stations give us data that are helpful. The figures of stations differ widely for several reasons. The degree of heat in the season when the crop was grown, the character of the soil and, especially, the variety of the peas are important factors. The date at which weighings and analyses are made and the variation in composition of mature plants in different seasons are responsible for much variance in published data.

PRODUCT PER ACRE.

At the Delaware Station, where the total number of pounds of air-dried matter in the tops and roots of an acre of red clover was four thousand and thirty-one pounds, the number of pounds of air-dried matter of cow-peas was four thousand and twenty-eight. This determination was made in November, and I assume that a hay crop had been removed from the clover land in June. While the total amount of vegetable matter to be given the land was the same in the cow-pea plot as in that of the red clover, the latter was found to be superior in fertilizing power, containing more nitrogen, as well as phosphoric acid and potash. On the other hand, many analyses show that the vines of cow-peas are richer than clover in nitrogen, and there is the seeming probability from all the data at hand that, ton for ton, there is little choice between clover and cow-peas as carriers of the fertilizer elements, so far as actual amount is concerned.

Prof. Henry, in his book on "Feeds and Feeding," states that a ton of clover hay contains forty-one pounds of nitrogen, while a ton of cow-pea hay contains thirty-nine pounds. In the cow-pea hay there is a higher per cent. of phosphorus and a lower per cent. of potash than in the clover.

Some of the more Southern states have gotten larger yields of vines and roots than that recorded above, but it is only in favoring soils and seasons, and with the best varieties that we may hope to get as good results as those of Delaware. In other instances, the yields given are smaller, as in the case of the Missouri Station, making a test on land so poor that it produced only eight bushels of corn and failed to mature clover at all. I quote from Circular of Information No. 6, Missouri Experiment Station:

"This plant appears to have the ability to thrive on land too poor to grow either red or crimson clover. It is not affected so seriously by excessive heat or drought, and is not easily smothered out by weeds.

"On most soils in Central and Southern Missouri it yields a larger quantity of vegetable matter, containing a larger total quantity of nitrogen, than does red clover. In the sections of the State where the climate is well adapted to the growth of cow-peas, it is believed that they will prove more satisfactory as a green manure crop that either red or crimson clover, especially on poor soils, inasmuch as there is less risk in securing a stand, and there is no danger of the hot weather in mid-summer killing the young plants.

"Compared with other green manure crops, the cow-pea seems to grow especially well on poor land. On a piece of naturally poor upland clay, which has, for the past fifty years, been grown in corn and wheat without fertilizer, the station began, last spring, a number of experiments in methods of restoring this soil to productiveness. On six of these plots cow-peas were sown without manure. The average yield of vines and pods, exclusive of the stubble, was as follows:

"Green substance, 2,650 pounds per acre, estimated to contain 28 pounds of nitrogen, 7.5 pounds of phosphoric acid and 21 pounds of potash.

"Rating these materials at their market price, in the form of commercial fertilizers, they would have a value of $5.90 per acre. Adjoining plots planted to corn gave an average yield of 8.1 bushels of corn and 860 pounds of field-cured stover. Other plots in the same series sown to millet, produced an average of 555 pounds of green substance. Common red clover, sown on similar plots, did not attain a height of five inches, and failed to mature."

FOR THIN SOILS.

The Missouri experiment has especial value for those who have thin soils, and one great advantage that the cow-pea has over the clover is its ability to make growth where clover will not do so. The amount of vegetable matter added to an acre in the Missouri experiment is not large, it is true, but it is rich humus-making material that is able to assist the soil to larger production. The cow-pea is a hustling plant, making an enormous growth where there are favoring soil and climatic conditions, and making a considerable growth on infertile land that would otherwise lie helpless.

FOR BETTER SOILS.

I would not give the impression that cow-peas should be grown in the North only on infertile soils. My own experience, for many years, was on land that is quite productive, the peas being used to provide fertility for a cash crop. The soil was well adapted to potatoes, but was refusing to grow clover, and there was a lack of rich organic material to furnish plant food and to keep the soil in prime physical condition. The cow-pea was introduced upon this potato land to produce the humus, and the growth was so great that it was practicable to follow the peas with two successive crops of potatoes, which repaid well for the labor and time used in growing the peas. In this instance soil-feeding was all-important, and the entire crop of vines was given to the ground, nothing being removed for sake of immediate income. The succeeding crop of potatoes could make more profitable use of this body of organic material than could any live stock under the circumstances. The seeming wastefulness of this practice subjects itself to the criticism of the scientists, and a discussion of the subject is not necessary here, but the experience is mentioned to illustrate the fertilizing power of this legume when grown on rich land.

AS A CATCH CROP.

The cow-pea has peculiar value as a catch crop, because it grows quickly. Clover is slow in its development, and there are many instances in which land lies bare for months, when it should have the protection of a cover crop and the benefit of some addition of humus.

Every season one may see considerable areas of meadow that contain too many weeds to make a profitable crop. Very often the weeds are not seen until the season is too far advanced for corn-planting, and more often there is not sufficient fertility to make a crop of corn. Such land, whether in whole fields or in strips of the field, should be broken at once and seeded to peas. In this way a fertilizing crop is secured where otherwise there would have been a nearly total loss of a season.

The meadow may be a clover field that is planned for a cultivated crop the next year, and a strip through it has become weedy on account of clover failure. When such a part of the field is seeded to peas in June there is a fertilizing crop on all the land, fitting it for a succeeding crop, and no time is lost.

COVER CROP.

There is no general public realization of the loss to land that occurs when it is left bare. Nature's method of improving soils includes their close covering as one of its important features. Very often i our scheme of farming we do not want to cover the land with plants that must be plowed down before another crop be planted or tillage can be given. Peas are adapted admirably to such a need.

In the growing of winter wheat, whenever our land can be broken early and fitted for seeding, covering the land with a growth of peas for six weeks before seeding time works well. The peas add fertility and shade the ground, and their growth is easily checked by harrow and float, while frost kills all that remains.

In the South this cover crop may be made into hay, but in the North the time is too short to grow a matured crop between harvest and seeding time, and the growth should be left on the ground. Bulletin No. 77, of the Arkansas Station, says:

"Aside from the manurial effects of cow-peas upon crops that follow them, they afford conditions peculiarly favorable to the proper preparation of the soil for the reception of fall-sown seed of whatever description or class. It is too frequently the case that grasses, clover, alfalfa and the like fail to succeed for no other reason than that the soil was not properly prepared for the seed, and that a promising growth of these hay and pasture crops comes to naught on account of the survival of the more fit weeds. In preparing soil for hay or pasture plants, one of the first essentials to success is the suppression of all weeds, and another is the thorough preparation of the soil for the reception of the seeds of these crops. Cow-peas have no superior in the suppression of weeds, and greatly facilitate and cheapen the preparation of the soil immediately preceding the sowing of pasture and hay crops. The cow-peas may be sown broadcast or in drills—if in drills, cultivation should be of such thoroughness and frequency as to prevent the growth of weeds until the cow-peas have complete possession of the soil. The cow-peas must be cut and removed in sufficient time for thorough preparation before the seed of the next crop are to be sown. The deeply penetrating roots of the cow-pea have a sub-soiling effect upon the land, and the dense shade promotes nitrification and improves to a marked degree the texture of the soil. Immediately after the removal of the cow-peas the soil should be prepared by frequent manipulations with such tools as disks, harrow, etc.

"If the treating and preparation for the preceding grain crop and for the cow-peas have been well done, going over the field three or four times with a good disk harrow will give an ideal preparation for grasses and clovers. Such treatment on well-tilled soil has given better results with winter wheat than were secured from deep breaking with a turning plow when no rain had fallen between the breaking of the land and the sowing of the wheat. Experience in a number of instances has proven the value of cow-peas for furnishing good conditions for fall-sown crops and particularly for grasses and clovers, both alone and in mixtures."

IN THE ORCHARD.

In orcharding, these peas serve well where there is sufficient heat. Cultivation of the ground to free fertility and to conserve moisture is desirable in the first part of the season, and then there should be a fertilizing crop to provide plant food for the trees the next spring. In old orchards in the North there is not sufficient heat under the trees to let the peas thrive, but in younger orchards they do well.

PERMANENCY OF SOIL IMPROVEMENT.

Some fertilizing plants decompose in the soil quickly, while others decay more slowly and produce a more lasting benefit. Cow-peas quickly decay, and I do not think that they exert as lasting an effect as clover. This means only that they are a more quickly available fertilizer than some others, and the land should not lie bare for any long time after peas have been grown or its loss by leaching will be serious. However, station tests indicate that some residual effects of a crop of peas may be seen in the third or fourth succeeding crop. The great availability of the organic fertilizer is a point in its favor if we have the wisdom to avail ourselves of it.

FEEDING VALUE OF COW-PEAS.

The cow-pea, like clover, furnishes a rich feeding-stuff for live stock. The percentage of muscle-forming element in the hay is greater than in clover hay, according to Prof. Henry. The peas, or seed, are yet richer, containing 20 or 21 per cent. of protein. Oats contain only 11 or 12 per cent. American feeding-stuffs, as a whole, are deficient in the element protein that makes muscle in the growing and working animal and milk in the dairy cow, and there is constant need of balancing up the fat-forming part of farm feeding-stuffs by means of purchased protein, in bran, gluten, and other by-products. An increase in the production of the Southern pea for feed, as hay, silage or grain, would assist in cutting down the bill for purchased feeds. In the South, there is no question about the profitableness of peas for hay and grain, and in the North there will be more extended use of this crop in this way when its worth is better known and methods of handling are understood.

There is greater limitation to use of peas for forage in the North than to their use for fertilizing the land. The soil or season may be too cold or the time too short to secure a vine growth that would make a satisfactory hay crop, while as a fertilizer the crop would be sufficient to be profitable. In Southern Ohio, however, I have found that peas should be grown for hay every year. There the heat is sufficient to make a good crop of vines on ordinary soil, and the hay is sufficiently rich to maintain horses at rest during the winter without any grain. As a food for dairy cows the hay is excellent, surpassing clover for milk production. The Alabama Station, after experimentation with pea hay as a substitute for bran, says:

"Viewing the results of the two preceding experiments together, it is evident that a good quality of cow-pea hay is worth 86 per cent. as much as wheat bran.

"This would probably not be true if we endeavored to support a cow in full flow of milk on hay alone, or almost entirely on hay. These tests showed that in rations containing 6 to 10 pounds of concentrated food (cotton seed, wheat bran, etc.), about 6.5 pounds of hay of vetch, or cow-pea, was practically as effective as, and much more economical than, wheat bran. In future tests, we hope to ascertain whether still larger amounts of leguminous hay can be substituted for corresponding quantities of wheat bran.

"Readers are cautioned against assuming that equally favorable results would be obtained by the substitution of limited amounts of grass hay for wheat bran. The hay of vetch, cow-peas, crimson clover, red clover and alfalfa is quite similar in composition to wheat bran, and much richer in nitrogenous material than hay made from the grasses. These leguminous plants, just mentioned, being rich in nitrogen, make not only rich food, but rich manure.

"Not least among the considerations which should impel the dairyman to displace wheat bran as far as practicable with foods grown on the farm, is the possibility that the wheat bran which he buys may be adulterated, even to the extent of being made up of 30 per cent. ground corn cobs.

"Still stronger reasons for supplanting wheat bran by leguminous hay are the reduced costs of butter and the improvement in the soil where even the stubble of cow-peas, vetch or other leguminous plants have grown."

Whenever cow-peas can be grown sufficiently rank to make one to one and a half tons of hay per acre, there is an opportunity of providing a cheap supply of protein for live stock. The soil, the season and the variety determine the northern boundary of the belt in our Northern states that may furnish the farmer with this rich hay.

PEAS FOR HOGS.

There is no better feed for growing hogs than peas, and the grain may be produced from dwarf varieties farther north than profitable production of hay is possible. This use of the peas fits nicely into the plans of those who plant peas primarily for soil improvement. The roots of the plants store nitrogen from the air, there is a big addition of organic matter to the soil, and very little is removed from the ground because the manure of the hogs is left in the field. The peas are ready for harvesting by the hogs late in August in the

North, and this feed carries the stock until corn is mature. Rapid growth is made on the peas, and then three or four weeks on a corn ration finish them for market.

PEAS FOR SILAGE.

Cow-peas have been preserved in the silo with success, although some failures are reported. The New Jersey Station, Bulletin 161, describes one experiment as follows:

"The peas were run through an ensilage cutter and placed in the silo without being mixed with any other crop. The silo was opened January 17, and, after removing about eight inches of the surface, the silage was found to be in excellent condition. The waste on the surface was somewhat more than the waste in the silo filled with corn. The animals ate the thirty-six pounds of silage with relish, in addition to the ten pounds of crimson clover hay per day. The yield of cow-peas ranges from eight to twelve tons of green forage per acre, depending largely upon the season."

The protein in this silage was fully as effective in the dairy ration as protein from dried brewers' grains and cotton-seed meal, but, in the North, the peas for silage should be grown with corn. A bulletin from the experiment farm of the North Carolina Horticultural Society says:

"Well preserved pea vines make silage far superior to corn, sorghum and other crops commonly used for this purpose, but it is difficult to preserve them alone. A growth sufficiently rank to make them profitable for silage is such a matted, tangled mass of vines that it is almost impossible to run it through a silage cutter, and, stored without cutting, they cannot be so closely packed as to exclude the air and prevent mold and decay and consequent loss. The most practical method with them for the silo is to grow cow-peas and corn in the same rows, so that the vines may twine around the stalks, and the whole be easily cut and handled together. The mixing of the two crops adds largely to the yield and makes the silage of much better quality. A ton of such a mixture has a feeding value fully 10 per cent. higher than that of an equal weight made from corn alone. For this purpose the Whip-poor-will is one of the best varieties, and should be planted with a common hand corn-planter, when the corn is about six inches high. By planting at that time, the vines run near or quite to the tops of the stalks and mature a good part of their seed by the time the corn is fit for cutting. The vines thus twined about the stalks are readily run through the cutter. Corn silage is poor, but that of cow-peas is rich in protein, so the mixture makes a more satisfactory food than that of either taken separately."

Bulletin 55, of the Delaware Station, gives the following experience on well-manured land:

"On the 10th of June the ground was plowed and Early Bristol seed corn was drilled in rows three feet nine inches apart. This variety of corn matures within ninety days after planting. On June 23, the corn plants were large enough to stand cultivation, and Whip-poor-will seed peas were drilled with the corn-planter along each corn row. This crop was cut for silage on September 21. It yielded 16 tons 150 pounds per acre. The pea vines had grown with the corn, which stood about 11 feet tall; all over the field the vine could be seen above the tops of the corn tassels. The corn harvester was used and did its work in a thoroughly satisfactory manner, even when drawn by one pair of medium weight horses. The silage cutter, however, was a small one, twenty-five tons per day of ten hours being the limit of its capacity; hence, the field work was not crowded. This harvester was set to make the smallest bundles possible. A number of these taken at random from loads at the cutter were weighed and found to average 38 pounds each. These bundles were opened, the pea vine was cut away from the stalks and each was weighed separately. By this means, it was found that the crop was made up of 24 per cent. of vine and 76 per cent. of corn. This result was a surprise, for a larger proportion of vine was expected and desired. One bundle was found in which the vine formed 56 per cent. and the corn 44 per cent.; this was, however, admitted to have been cut from a section of a row where the corn stood badly and the peas had an abundance of sunlight and food."

At this station the corn and pea silage was of good quality, and was fed with entire satisfaction to dairy cows, the protein in the peas taking the place of a part of the costly protein in purchased feeds.

PALATABILITY.

All animals like the food to which they are accustomed by life-long habit. The taste for new food often must be acquired. Many a northern experimenter has quit cow-peas in disgust because his horses, cows and hogs refused to touch them when first placed before them. It was my experience that a horse would practically refuse pea hay the first day, would eat moderately of it the second and within a week would become inordinately fond of it. Dairymen report similar experiences.

As a supplemental food during August, when pastures are short, peas are excellent, but cows usually refuse the green forage for a day or two, and then soon show a great liking for the new feed. I think that there are few animals that will not learn quickly to like a feed of cow-peas, either green or as hay, if the feeder has any patience or skill, and if he lack these qualities, the live stock will fare ill at his hands under any circumstances.

VARIETIES.

There are many varieties of cow-peas, just as there are many varieties of corn. If corn were new to the Northern states, and every farmer made a test of "corn" for his farm, regardless of variety, the reports of failures would be many. There are varieties of peas that have trailing vines fifteen to thirty feet in length, and some of these require six months of southern heat to bring them to maturity. Others are very dwarf, making a bushy growth, and maturing seed in eight weeks. Of the three or four score varieties, a few only were supposed at first to be adapted to any part of the Northern states, and an effort has been made to develop varieties still more early and hardy. This results in dwarfing and in reducing the fertilizing power of the crop. The thought seems to have been that the peas could not be a success in any locality unless a variety was secured that would mature the seed. If grain were a chief consideration, as it is with corn, the reasoning would be correct, but if the cow-pea should be regarded first as a crop for improving the soil, it is a mistake to seek a variety so dwarf that seed can be matured in eight weeks under the northern sun.

Varieties vary in their habit of growth according to the nature of the soil. The trailing varieties grow more upright and dwarf in a poor soil, and so-called bunch varieties send out trailers in a very rich soil.

General speaking, the bunch varieties are the best producers of seed, and where feed for hogs is wanted we do well to plant them. For hay, also, the bunch varieties are desirable on account of ease of harvesting, but in nine cases out of ten the northern grower should seek first the heaviest possible growth of vines that will come near to maturity before frost, and if this is secured, the crop will repay the grower, either in forage or fertility. Concerning varieties, the Illinois Station, in Circular No. 69, says:

"There are over seventy varieties of cow-peas, differing greatly in character of growth, development of vine, yield of seed, and length of time required for maturity. The so-called bunch varieties grow upright, while others, under the same conditions, are running varieties, sending out trailers or running vines sometimes fifteen to twenty feet long. Often the same varieties vary greatly in their character of growth upon different soils. For instance, the Whip-poor-will grows an upright, stalky plant upon poor, thin soil, while upon rich, black soil it makes a very rank-growing trailer. The varieties more commonly grown in Illinois are Warren's Extra Early, New Era, Whip-poor-will, Early Black-eye, Red Ripper and Warren's New Hybrid. Probably the most commonly grown variety is the Whip-poor-will, which is not a prolific seed producer, but has a tendency to a very rank growth, especially on the rich soils of Central Illinois, although on the light clay soils farther south it grows stalky. The best variety to plant depends upon the purpose for which the crop is grown. Where the crop is to be turned under as a green manure, a rank-growing running variety, as the Whip-poor-will, can be used, but where the crop is grown for seed or hay, a more dwarf-like seed-producing variety is preferable.

"In the season of 1902, twenty-two varieties of cow-peas were planted under the same conditions, with the object of comparing the yields of seed. The following were the yields per acre of the varieties tested:

Name of Variety.	Yield—Bu. per Acre.
Warren's Extra Early,	38.7
Warren's New Hybrid,	38.3
Old Man's,	33.5
New Era,	31.7
Red,	24.2
Iron,	23.0
Early Black-eye,	22.3
Gray Goose,	21.7
California Black-eye,	18.7
Whip-poor-will,	15.6
Black,	15.0
Southdown,	13.2
Large Black-eye,	12.0
Couch,	10.0
Indian,	10.0
Red Ripper,	8.1
Holly Brook,	8.0
Wonderful,	6.0
Lady,	5.0
Clay,	Not mature.
Taylor,	Not mature.

"All of these varieties were planted June 14, in drill, three feet apart, and all had equal conditions of soil, moisture and cultivation, so that the differences shown are due to the variety planted. The late planting, together with an early frost, prevented some of the later varieties from maturing. Another variety, North Prolific, was planted upon the same kind of soil two weeks earlier and yielded at the rate of 40 bushels to the acre.

"This test revealed the fact that for seasons like 1902, at least, there are several varieties of cow-peas, which, in the matter of yield of seed, are far superior to the Whip-poor-will, which is probably more commonly grown than any other varieties in this State. When a tendency to seed production was noticed, a more dwarfed growth was evidenced and *vice versa.* The Warren's Extra Early, Warren's New Hybrid, Old Man's, Northern Prolific and New Era varieties possessed the bunch habit of growth and yielded the greatest amount of seed.

"These varieties are early maturing, easy to cure for hay and on rich soil are among the best varieties for these purposes. The Whip-poor-will, Red Ripper, Clay and other late varieties grew more to vine, yielded less seed, matured later, and were more difficult to handle and cure for hay on account of their very heavy growth of vine and leaf."

In Southern Ohio, it is my experience that no variety is more satisfactory than the Black. It is not early, requiring nearly the entire season to ripen seed, and it trails bad on this land, but on thin land the earlier varieties do not make a sufficient growth. We grow the peas primarily to get more soil fertility, and when the vines are made into hay it is well for the soil that we cannot cut everything off with the mower. The long stubble that is left when mowing trailing peas commends a variety to one who believes that the chief office of the cow-pea in the North is to improve soils, and that the feed gotten from hay and seed is a secondary consideration, though a highly valuable one. Just how far north the Black may be used with profit I cannot say, but it is worthy of a trial in all the warmer sections of Pennsylvania.

The Whip-poor-will is another desirable variety for trial in the North. It makes less vine than the Black, and has a more upright habit of growth. When the Black will not come near enough to maturity to make hay, the Whip-poor-will may serve. The exceedingly dwarf varieties do not commend themselves as rapid soil-builders. In this connection I quote from a correspondent of the Michigan Station, Bulletin No. 199:

"In the spring of 1896, I sowed thirty-five acres of Mammoth Clay cow-peas, using one and a half bushels to the acre, sown broadcast, with an ordinary grain drill. The soil had been much run and was especially destitute of humus. The season was wet, and they made a very large growth, completely shading the ground and smothering the weeds.

"The ground was literally filled with nodes and roots after the first of August, and very little of them before that time. A part were plowed under before frost struck them and a part late in October, while some were left until spring. In the following crop, as well as in texture of soil, I could see a marked difference in favor of those which laid on the top of the ground all winter. The soil was made mellow and the surface crust very much less firm and brittle.

"The next summer I used the Mammoth Black and a dwarf variety. The season proved very dry and little growth was secured. The dwarf shaded the ground very little, and weeds took possession of the ground.

"The next year 40 acres of Whip-poor-will were sown, which, although the season was dry, made a fair growth and ripened considerable seed, although it hardly paid to gather it.

"The results of my experience convince me that the cow-pea is to be an important factor in bringing up our land, so that we may again use the clovers. What we must have is humus and mineral elements, so that the clover shall secure a rootage before the drought sets in.

"When sowing the peas, in each case, I drilled in with the seed 300 pounds of fine ground bone and spread about 25 bushels of wood ashes to the acre, which, I am sure, had a marked effect on the growth of the plants.

"I am satisfied that all dwarf varieties should be discarded and that no attempt should be made to grow the seed in Michigan. Use only the Mammoth Clay and Wonderful pea, and sow about the first of June, one and a half bushels to the acre, using the mineral fertilizers, and, leaving the vines on the ground unmolested until the following spring, when they will be decayed enough to break up and be mixed with the soil by plowing and harrowing."

Our soils, climate and particular needs are so variable, however, that the individual grower does well to test a number of varieties, and the insistance here placed upon the value of the ranker-growing ones is only to try to counteract the false impression that early maturity in peas is the chief consideration, while we should rather seek the biggest growth possible under our northern sun, provided only that it will come fairly near to maturity before frost. Seed can be gotten each year from sections in which it does mature.

GOOD SEED.

The seed of the cow-pea is normally comparatively low in germination. This is not true of any individual lot that has been matured and cared for properly, but it is true of the seed on the market, taken as a whole. Immaturity, bad weather and careless handling are causes. I recall one lot of seed obtained from a southern seeds-man that was down to 50 per cent. in a germination test. Very many partial failures in northern experiments with cow-peas are attributable to poor seed. The supply in some years is far better than in others. Great care should be exercised in the selection of seed, and a sufficient amount of good seed should be used to obtain a full stand of plants. When I find that only one-half of the seed will germinate, I double the quantity used per acre.

Varieties vary in their habit of growth according to variation in soil and climate conditions; for this reason, I prefer seed that is grown not far southward. We can easily attach too much importance to the fact that a lot of seed is northern-grown when we want forage or fertility for the soil, but, on the other hand, we do not want Gulf seed for northern planting.

There is difficulty in getting seed true to name, but, as in all matters of purchased seed, the best that we can do is to order from reputable parties.

The prices asked by some northern seedsmen are unreasonably high. When one can mature seed of the variety desired by planting a piece of warm soil for that purpose, it is best to grow one's own supply. But I prefer to take the risk of purchase rather than to abandon a rank-growing humus-making crop, simply because that variety does not mature sound seed in my latitude. The ability to ripen seed any season may only evidence a dwarfness that renders it less valuable.

METHODS OF GROWING COW-PEAS.

The ground should be prepared for peas very much as it is for corn. In our colder climate it is necessary to give the peas a fair opportunity to use every day of the growing season to advantage, if a full crop is wanted, and that means a good seed-bed. If the ground is fresh plowed, loose and cloddy, the peas cannot get enough moisture and fertility. It pays to fine and to firm the ground, so that the seed will germinate quickly, and the plants can make constant growth.

The time to plant is shortly after that of planting corn. In the latitude of Harrisburg, this work should be done by June 1. If it is done much earlier, there is danger that cold rains will cause the seed to rot in the ground; if much later, the season is too short for the varieties that give much forage or fertilizing material.

The method of planting may depend upon the object of the crop. If it is being used on thin land, as a preparatory crop for wheat and a grass sod, I greatly prefer to drill the seed in rows, so that cultivation may be given. The land needs the summer tillage, and the shallow cultivation, freeing the surface soil of weed seed and keeping it loose, puts it into prime condition to be mulched by the vines later in the summer, and then to be seeded after the crop has been made into hay or has been chopped up with a disk harrow, so that it may be left as a mulch on the ground.

An ordinary grain drill, having hoes eight inches apart, can be used in such planting by having all holes in feed box closed, except two, making the distance between rows 32 inches. Some growers use a corn planter, driving so that the distance between rows is one-half that of corn rows. I prefer the grain drill, and want the seed covered only sufficiently to insure germination. In clayey soils the planting should be done as soon after a rain as ground will permit, the aim being to get the plants up before any beating rain may come. Poor stands, in heavy soils, are often due to a crusting of the surface that prevents the plants from coming up. The cultivation should be shallow and sufficiently frequent to prevent weed growth. In my own fields three cultivations, on the average, have been given before the vines were large enough to shade the ground fairly well.

When growing cow-peas to provide a rich humus for a cultivated crop the next season, it is not necessary to incur the expense of cultivation. The seed may be drilled in with all the hoes of a grain drill, or it may be broadcasted and covered with a disk harrow. In a moist time the peas will sprout on the surface of the ground, and haphazard work in planting often gives fairly good results. I wish to insist, however, that in cool latitudes it pays to prepare land well and to plant carefully, giving the crop an opportunity to do as well as is possible.

AMOUNT OF SEED PER ACRE.

In the South there have been some experiments whose results indicate that thin planting of cow-peas favors yield, both of vine and seed, but this is contrary to common opinion of growers, and I am sure it is not true for the North. Comparatively thin seeding favors seed production, but in our colder latitudes we cannot secure a rank covering for the soil without rather heavy seeding. The amount of seed per acre depends upon the method of planting, and it depends, of course, upon the quality of the seed.

In drills 32 inches apart, 12 quarts of choice seed, or one-half bushel of the ordinary seed on the market, will give a good stand of plants in a good seed-bed.

When the seed is broadcasted, so that no cultivation can be given the crop, five pecks per acre should be used.

The old rule of seeding holds good, that the poorer the soil the greater the amount of seed that should be used.

PLANTING IN OLD PASTURES.

In the renovation of old pastures the cow-pea may play an important part. While it needs a good seed-bed and good tillage to make a maximum crop, or to put a field into a fine state for seeding to grass, it is a hustling plant under adverse conditions. When pastures become worn and weedy, and it is not feasible to break them for reseeding, it is a good plan to run a disk harrow over the parts where the sod has disappeared, and then to broadcast peas, together with grass seed. A second harrowing will give more fresh soil and will cover the seed. The peas will add nitrogen to the soil and provide forage for stock while the grass is starting. Where stock can be kept off the peas until August or September, much more can be accomplished for the ground.

FERTILIZERS.

It usually pays to use a fertilizer containing phosphorus when planting peas. This element is usually lacking wherever fertility is lacking. While nitrogen is also wanting in thin soils, station results indicate that it is unprofitable to buy it in a fertilizer to apply to peas, because they are able to use the nitrogen of the air. On thin land, however, a dressing of stable manure shows in the crop just as it does with all other crops. But I should not advise such disposition of the supply of farm manure.

The peas should be given phosphorus—200 pounds per acre, of a good acid phosphate—and potash should be added if there is a known need of potash, as is the case with limited areas of land in the North. The peas will draw upon the free nitrogen of the air for that element, if the two other elements are not lacking.

LIME.

An advantage that the cow-pea possesses over clover is its ability to thrive in sour soil. The soil acids that prevent the growth of clover do not affect peas unfavorably. On the other hand, the liming of land to destroy soil acidity not only does not benefit peas at all but seems rather to do harm to this crop. The Alabama Station reports:

"Two tests were made on this point, using drilled cow-peas of the variety Wonderful, fertilized with acid phosphate, and cultivated several times.

"In 1897, on reddish loam soil, and stiffer than that in the later tests, the yield was 5.6 bushels of peas without lime and only 5.2 bushels where slaked lime at the rate of 640 pounds per acre had been applied broadcast in February of the preceding year. Whatever lime remained in the soil was evidently of no benefit to cow-peas.

"In March, 1898, water-slaked lime was used as a top-dressing on oats on gray sandy soil. It was used at the rate of 1,000 pounds per acre of the unslaked lime, which is equivalent to a much larger weight of the slaked material.

"After the oats were cut, the land was plowed and cow-peas drilled in and cultivated as necessary. The yield follows:

"Plot not limed, 13 bushels cow-peas per acre.
"Limed plot, 10.2 bushels cow-peas per acre.

"Clearly, lime was of no benefit, but apparently injurious as regards seed formation. There was no notable difference in the appearance of the vines."

We have learned to use light applications of lime on acid soils to induce the growth of clover, but where we depend upon cow-peas as a source of humus and the means of giving nitrogen to the land, soil acidity is not in the way of getting big crops. This fact has been made plain on my own farm, where clover was failing in some fields on account of soil acidity. On this land the crops of peas have been large, giving fertility for potatoes and grass.

DISPOSITION OF THE CROP.

Cow-peas are grown in the North:

(1.) To prepare thin land for seeding to grass and clover, with or without a grain crop;
(2.) To supply a soil with the greatest possible amount of rich vegetable matter;
(3.) To provide hay or silage;
(4.) To afford pasture;
(5.) To provide seed;
(6.) To protect bare land and to renovate old pastures.

The treatment of the crop depends upon the object one has in view. Believing that the widest field for usefulness of the cow-pea in the North is that of affording a good seed-bed for grass where soils are thin, I deal, first, with the treatment of the crop when sods are the ultimate object.

ON POOR LAND.

On preceding pages of this bulletin the theory of securing sods has been given. I wish to say, here, that the theory is not one that has been formed because it seemed reasonable, but it was evolved during and after successful practice to account for results that were being secured. On some thin land of my own farm, and on a tract of thin land in which I had interest, I have seen heavy sods secured by correct treatment of the cow-pea crop in making a proper seed-bed for grass and clover, and in this one matter I feel that I may speak with the certainty of correctness.

Assuming that the peas were grown successfully in drills on the thin land, good tillage having caused the destruction of weed seed in the surface soil, the object now is to give that soil all the crop as a top-dressing—a mulch and manure—or to give to this land as much of the pea crop as it needs for a top-dressing. In my own experience, the soil of a field varies so in fertility that the same treatment for all the field may not be required. Where the soil is thinner and the growth of peas is not very rank, all the growth should stay on the land, being chopped into the surface soil with sharp disk harrows. Where the growth is very rank, as in swales of the field, the vines are permitted to mature sufficiently for hay, and a portion of them is made into hay and removed from the field. Using trailing varieties, I fail to cut off all the vines with the mower, and what is left, together with some leaves, the stubble and roots, gives to this better soil all that is needed to fertilize the grass crop. Bearing in mind that the object of the crop is to secure a good sod, there is no robbing of the thin land. All the cow-pea crop is left on land needing it, and a portion is left where that will be sufficient.

When the crop is to be left on the land, the first cutting with disk harrow should be given while the vines are green and tender. A double-cutting, with weight on the harrow, severs many runners from the plants, and these begin to decay in the fresh soil. A week or two later, a second double-cutting is given at right angles to the first, followed by a heavily-weighted plank float that bruises and crushes many plants that are not uprooted by the harrow. Many plants continue to make some growth, but this is no detriment as frost will kill them. There is now enough fresh soil for seeding to winter grain and grass or to grass and clover alone.

The soil has produced its own coat of rich manure and the surface is in choice physical condition for seeding. If the disking has been done in time, and if the rank patches of peas were made into hay, a grain drill can be used by throwing the hoes out of line and using an extra man to assist in dislodging the material that remains undecayed. Farther south, where the heat favors heavier growths, the vines are made into hay, dependence for fertility being had upon the stubble and roots. The Arkansas Station says:

"Aside from the manurial effects of cow-peas upon crops that follow them, they afford conditions peculiarly favorable to the proper preparation of the soil for the reception of fall-sown seed of whatever description or class. It is too frequently the case that grasses, clover, alfalfa and the like fail to succeed, for no other reason than that the soil was not properly prepared for the seed, and that a promising growth of these hay and pasture crops comes to naught on account of the survival of the more fit weeds. In preparing soil for hay or pasture plants, one of the first essentials to success is the suppression of all weeds, and another is the thorough preparation of the soil for the reception of the seeds of these crops. Cow-peas have no superior in the suppression of weeds, and greatly facilitate and cheapen the preparation of the soil immediately preceding the sowing of pasture and hay crops. The cow-peas may be sown broadcast or in drills—if in drills, cultivation should be of such thoroughness and frequency as to prevent the growth of weeds until the cow-peas have complete possession of the soil. The cow-peas must be cut and removed in sufficient time for thorough preparation before the seed of the next crop is to be sown. The deeply penetrating roots of the cow-pea have a sub-soiling effect upon the land, and the dense shade promotes nitrification and improves to a marked degree the texture of the soil.

"Immediately after the removal of the cow-peas the soil should be prepared by frequent manipulations with such tools as disks, harrows, etc. If the treating and preparation for the preceding grain crop and for the cow-peas have been well-done, going over the field three or four times with a good disk harrow will give an ideal preparation for grasses and clovers. Such treatment on well-tilled soil has given better results with winter wheat than were secured from deep breaking with a turning-plow when no rain had fallen between the breaking of the land and the sowing of the wheat. Experience in a number of instances has proved the value of cow-peas for furnishing good conditions for fall-sown crops and, particularly, for grasses and clovers both alone and in mixtures."

RELATIVE VALUE OF ROOTS AND VINES.

There has been much work done by stations to determine the relative fertilizing values of the various parts of the plant. A bulletin of the Mississippi Station says:

"In the weighings which we have made we have found the weight of the roots in the upper foot of the soil to be from one-fourth to one-third the weight of the vines. It is impossible to give the exact weight of the leaves which drop from the vines during the growth, or of the stems and other parts of the plants which are left on the ground in making hay, but as the leaves are richer in nitrogen than is any other part of the plant excepting the seed, they certainly add very largely to the fertilizing value of the crop. The Louisiana Station found the weight of the roots to be about one-third that of the vines, the proportion being about one-fifth in the running varieties, while some of the bunch varieties showed equal weights of roots and vines. Similar weighings have been made at other stations, with similar variations.

"Chemical analyses show the roots to contain a smaller percentage of phosphoric acid and nitrogen and a larger percentage of potash than is found in the vines.

"Including the roots, the leaves which are dropped during growth, and the various losses which occur in harvesting, it is certainly safe to estimate the weight of the material usually left in the field as being not less than one-third the amount carried away, and in many cases the amount of vegetable matter left to decay in and on the soil is fully equal to that carried away as hay."

FILLING THE SOIL WITH HUMUS.

When the peas are grown purely for soil improvement, it is a common practice to plow them under, just as clover is plowed under. This method should not be adopted when fall grain is to follow, because it makes too loose a seed-bed, and also for the reason that the plowing would necessarily be done in hot weather, and it is always dangerous to plow down a great mass of green stuff in hot weather. Acids are formed that injure the soil, and harm the crops to follow.

I have used peas largely to enrich land for potatoes, turning the vines under in the fall or the succeeding spring. The fertility in a pea crop becomes available so quickly there is loss when the land is left without living plants from early fall until late spring, and with me it is good practice to plow when the vines are mature and to seed to rye for a winter cover crop. The rye is then turned down before it is a foot high, to prevent any injury to the moisture supply, and in these two fertilizing crops enough humus is gotten to feed two successive crops of potatoes. In defense of the practice of plowing down a mass of humus-forming material, the North Carolina Horticultural Society, in its bulletin on the cow-pea, says:

"Of late some able and scientific writers, probably blessed with ample means, have been protesting against the wastefulness of plowing under cow-peas.

"It is asserted that vines, to make a ton of hay, if turned under green, add only about as much actual fertility to the soil as one-third of a ton of high-grade guano, but, turned into hay, fed to live stock and their liquid and solid excrements carefully saved and returned to the land, increase the fertility twice as much. Vast numbers of the tillers of the soil lack live stock, suitable buildings and yards, labor and bank accounts. The farmer may find it much more profitable to follow the less economical method of plowing under than of buying complete fertilizer, converting it into hay or leaving his fields unfertilized."

In a discussion of the time of plowing down a crop of vines, the Arkansas Station says:

"Having grown a crop of cow-peas for its fertilizing effects upon the soil, the treatment should be such as to secure the best results with the least harm to the crop that is to follow, and with the least loss of the fertilizing ingredients of the cow-pea plant. If the soil is of a light sandy nature, and subject to washing by winter rains, fall plowing should be avoided unless there is an excessively large quantity of the pea vines to be plowed in. In the South the soil is not frozen enough to prevent the decomposition of the vines in the winter, and there may be a decided loss of the fertilizing ingredients, and the heavy winter rains will do more damage to freshly plowed areas on rolling ground than the fall plowing will do good. A decided majority of southern soils are very subject to washing, and usually suffer greater loss of plant food by their not being protected from washing than by the removal of plant food in the crops taken from the soil. Such soils are not benefited by fall plowing so much as they are harmed, and need the protection of terraces and whatever vegetation it is possible to have upon them through the winter. Soils that are of a compact nature and not subject to washing are benefited by fall plowing, and on such soils the cow-peas may be plowed under in the fall. In either case, however, a winter cover crop will aid in binding the soil against washing and take up valuable plant food that otherwise would be lost. Upon light soils it is often a serious error not to follow fall plowing with rye, wheat, oats or some other winter crop. These catch crops far more pay their cost in improvement and protection to the soil, and may be harvested or plowed under in the spring, to be followed by whatever crop it is the intention of the farmer to grow.

"It is often a difficult task to plow under a heavy crop of cow-peas and have the soil in good condition and the vines well covered. This difficulty is particularly noticeable when Iron, Clay, Red Ripper and such vining varieties are to be plowed under, the tangled mass of vines making it in many cases impossible to do a good job with the tools ordinarily found upon the farm. In plowing under such heavy crops the work may be done quite satisfactory, if the field is first gone over with an ordinary stalk cutter, and in such manner that the furrows of the turning plow will be parallel with the direction of the stalk cutter. The blades of the stalk cutter cut the pea vines into strips at right angles to the furrow, and a rolling coulter attached to the beam of the turning plow cuts the vines again, but at right angles to stalk cutter. The stalk cutter presses the vines near the ground, cutting them one way while the coulter cuts them again, enabling the plow not only to run more steadily, but to completely cover the pea vines, insuring their more rapid and uniform decomposition."

There is great difficulty in plowing the peas down in the fall as soon as the crop is mature. I have found that the work may be made easier by running a heavily weighted disk harrow ahead of the plow. It partially cuts and straightens the vines. But the better way when vines are heavy, is to pasture the field for a short time with live stock that is not removed from the field during the period of pasturing. The fertility is thus kept on the ground. On this point the bulletin of the North Carolina Horticultural Society, quoted above, says:

"Theoretically, the most economical way to use the crop is to graze the fields and plow under the stubble. The solid and liquid droppings of the animals contain nearly all of the plant food that was in the forage. There is a small loss, but it is hardly as great as when the vines are left on the ground during the winter.

"Grazing the field and turning under stubble and animal droppings does away with the difficult, often expensive, work of plowing under a great mass of vines, when labor is scarce or wages high. Cow-pea pastures are especially valuable for milch cows and growing hogs, and make more milk and pork per acre than any other grazing. Hogs use the crop more closely than cows, and are less particular about quality of food, so it is well to let them finish what the cattle have left. Hogs make good growth and fatten on such pasture; yet it is better to add some other and suitable feed during the last month or so of their feeding for market or pork, or 'finish off' on corn, as otherwise meat and fat are likely to be too soft and lacking in quality and delicacy of flavor. As intimated above, a fairly good pea crop is rather difficult to plow under with its entire mass of fresh, green vines, but grazing a few days makes the covering easier and causes practically no loss of plant food."

MATURITY WANTED.

When plowing down any fertilizing crop for soil-improvement it should be borne in mind that there is always loss when the work is done before the plants approach maturity. Prof. H. J. Waters states the facts clearly as follows:

"The common impression among farmers is that these crops must be turned under when very green in order to produce valuable manure; that if allowed to mature or become dry, much of the valuable fertilizing material will be lost by evaporation. This is entirely incorrect. A larger yield will be obtained by allowing the plants designed for manure to become mature. Of course, an exception should be made in the case of weed crops whose seeds are likely to be troublesome afterward. Recent experiments show that red clover, when plowed under at the beginning of the blossom, contained little more than one-third as much nitrogen as when matured.

"In the case of cow-peas, except on poor land, where a large supply of fertilizing matter and vegetable material is needed immediately, it will usually be found more profitable to pasture them with hogs or other stock, and turn the refuse vines under late in the fall or the following spring. Where a very rank growth of clover or cow-peas is secured, much of the difficulty usually experienced in turning it under may be obviated by first running a harrow over the field in the direction, in all cases, that the plow is to go, and so break and straighten the vines that, with the aid of a rolling coulter, they may be easily plowed under."

PEAS FOR HAY AND SILAGE.

The feeding value of the cow-pea vines is so great that their use as green forage, hay and silage will increase. The only drawback in the North is the inability to get luxuriant growth of vine, except under very favorable conditions. I have found the hay a cheap feed for idle farm horses during the winter, and it is exceptionally good for growing stock and for dairy cows. The only difficulty is that of making the hay in the early fall. The right time to harvest is when the pods are well formed, a few turning brown, and when some leaves have browned. This stage of maturity of the varieties that make a fairly rank growth does not come until September in the Northern states, and then the nights are cool.

There are various ways of curing the vines for hay. Good authorities recommend the practice of curing in the mow, exposing the vines to the weather only long enough to evaporate all outside moisture. I cannot commend this plan to our readers, believing that, with limited quantities and in a cool climate, they will lose the feed.

It is my own experience that there should be quite thorough curing in the field, and rain does far less injury than many have supposed.

Over-exposure of the leaves to the sun should be guarded against. They soon become dry, and then will drop off. The loss to the hay by dropping of the leaves is serious, because they are twice as rich in muscle-making material as the stems.

A good plan for the northern farmer is to cut the peas with a mower, rake as soon as the leaves on top the swaths begin to crisp, leave in windrow until the top leaves begin to burn, and then put into small cocks. If the variety is a trailing one, labor and temper of workmen are saved by turning the width of the rake over upon a second width, and letting this amount form one cock. If the vines are heavy, the windrow should be small.

When these cocks have stood a day, they may be inverted. If rain comes, there is some injury, of course, but it is not great unless long continued. After a day of drying, invert the cocks again. They dry pretty readily. Do not try to scatter the hay; it will dry if the weather will let it. If the vines could be cured with certainty in the mow, the hay would be better; but in our cool September weather I prefer to spend about five days curing pea vines in swath, windrow and cock. The cocks are thrown upon the wagon in single forkfuls, either by one or two workmen, and a horse-fork at the barn does the rest.

Storing in the silo was touched upon under another head. The North Carolina Society says:

"Well preserved pea vines make silage far superior to corn, sorghum and other crops commonly used for this purpose, but it is difficult to preserve them alone. A growth sufficiently rank to make them profitable for silage is such a matted, tangled mass of vine that it is almost impossible to run it through a silage cutter; and, stored without cutting, they cannot be so closely packed as to exclude the air and prevent mold and decay and consequent loss.

The most practical method with them for the silo is to grow cow-peas and corn in the same rows, so that the vines may twine around the stalks, and the whole be easily cut and handled together. The mixing of the two crops adds largely to the yield and makes the silage of much better quality. A ton of such a mixture has a feeding value fully 10 per cent. higher than that of an equal weight made from corn alone. For this purpose the Whip-poor-will is one of the best varieties and should be planted with a common hand corn planter, when the corn is about six inches high. By planting at that time, the vines run nearly or quite to the tops of the stalks and mature a good part of their seed by the time the corn is fit for cutting. The vines thus twined about the stalks are readily run through the cutter. Corn silage is poor, but that of cow-peas is rich in protein, so the mixture makes a more satisfactory food than that of either taken separately."

FOR PASTURE.

Peas make rich pasturage for all kinds of farm stock. I do not think, however, that we shall grow them extensively in the North primarily for pasture. For feed for hogs they are especially good, and, when the vines are growing for soil-improvement, it is highly profitable to let the grain be harvested by hogs before the plow is used.

PEAS FOR SEED.

Bulletin 69, of the Illinois Station, describes the method of saving seed as follows:

"Where cow-peas or soy beans are left for seed they should be allowed to fully develop, but not to get so ripe that the seed shatters out in handling. It is best to cut them slightly green and then allow the seed to get perfectly dry before threshing. Formerly, beans and peas were picked by hand, but now the work is done almost exclusively by machinery. The bean and pea harvester, or cutter, is a two-wheeled machine, having two long steel blades so adjusted that as the machine passes down the rows they sweep along just at or below the surface and cut the bean stalks. The blades are set obliquely, sloping backwards and towards each other, so that the two rows of beans which are cut at one time are moved toward each other and left in a single row. The beans or peas may be left in this windrow until threshing, or piled up in small bunches with a fork. After drying one day or more the bunches should be turned, so that all will dry out thoroughly.

"If drying weather prevails, they will become fit for threshing or storing in barns without further turning, but, if the weather is unfavorable, the bunches must be frequently turned to prevent the beans in the pods resting on the ground from becoming damaged. Wet weather does not seriously injure the crop (especially the soy bean crop), provided the pods are not allowed to rest on the wet ground too long at a time. When thoroughly dry, the vines are stored in barns or threshed immediately. The threshing is best done by specially constructed machines, in which the first cylinders are reduced in speed, and the rest of the separator maintained at ordinary speed. Threshing is best done with a bean thresher, such as that made especially for the purpose, but a wheat separator may be used with all blank concaves and running as slowly as the machine will permit and not clog the shakers.

"After threshing, care must be taken in storing the seed, particularly the soy bean, as it is so rich in oil that any external moisture sets up a fermentation which may produce heat enough to cause injury to its vitality. The seed should be thoroughly dry before threshing, and may be stored in loose woven sacks or bulked in bins, if tile or brick is used. The expense of growing, harvesting and threshing cow-peas or soy beans, according to the Kansas Experiment Station, is about 55 cents per bushel for an average crop."

In a small way I have had the seed saved by hand-picking the pods. Enough pods to thresh out 20 to 40 bushels of peas are stowed in a dry loft until the weather is cold and dry and then threshed with a flail, the seed being cleaned with a fanning-mill. It is a primitive method that meets the needs of a small grower, who wants to save seed for his own planting.

To protect the seed from weevil, treatment with bisulphide of carbon should be given. The grain should be placed in a tight box or bin and the liquid should be placed in an open dish on the surface. The bin should be covered closely with canvas to prevent loss of gas, as evaporation takes place. The gas is heavier than the air and sinks throughout the grain, killing all animal life. One pound of the bisulphide of carbon to each 25 to 50 bushels of grain is sufficient.

When peas are grown as a cover crop for orchards, the vines are left on the surface of the ground until spring, when cultivation again begins.

AS A SMOTHER CROP.

In the eradication of weeds, peas serve well as a smother crop. The Arkansas Station, in discussing the eradication of nut grass and Johnson grass, describes a rotation that I have found valuable for other weeds. It is as follows:

"When it becomes desirable to eradicate these weeds the farmer will find in the cow-pea one of his most powerful allies. If the field infested is thoroughly plowed and harrowed in August or September, when the soil is dry, and cultivated so as to prevent further growth until rye is thickly sown broadcast late in September or in October, the first steps toward eradication will have been taken. Before the weeds will have begun to grow the following spring, the rye will so cover the surface of the soil as to weaken their growth. When the rye is removed in May, plow the field shallow, harrow and cross harrow as soon as the rye is off. Repeat the harrowing a week later and sow from one to two bushels of cow-peas broadcast. Early in the fall cut the cow-peas and remove from the field as soon as possible, plow the stubble and thoroughly cultivate with harrow, continuing the cultivation at intervals until frost. The rye so shades and crowds the weeds in the early spring that their growth is feeble. The thorough preparation for cow-peas prevents their growth, and the more rapid growth of the cow-pea gives them the start of the weeds, covers the whole surface of the soil and permits but little other growth. The removal of the cow-pea in August, September or October exposes the enfeebled weed growth to the hot sun, and cultivation continued at frequent intervals until the first killing frost will leave very little vegetation capable of growth. The products of rye and cow-peas will more than pay for the cost, and this plan is quite effective with Johnson grass. The tubers of nut grass, in some cases, will sprout the second year, and it may rarely be necessary to repeat the process. Weeds other than the two mentioned are more easily subdued, and if smothered as suggested will not be troublesome."

CONCLUSION.

I have not sought to make a special plea for the introduction of a new crop into anyone's farm scheme. Rather, I have sought to state with accuracy some facts about the cow-pea that I have gained in my own experience and some facts taken from experiment station work that will hold good in northern latitudes, and with this plain statement I leave the matter with the hope that all readers who need this legume will make use of it, and those who are getting good results with the clovers, soy beans, etc., will not expect to gain anything from displacing known friends by untried ones. There is wide room for these peas in the North, but they can gain a foothold only as they are tested intelligently by men who know their own needs and see the right way of letting this southern friend serve them.